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| 10/725,903 | 12/01/2003 | Bernhard Wieneke | F-8054 | 3194 |

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| EXAMINER |
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CHEN, CHIA WEI A

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| ART UNIT | PAPER NUMBER |
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2609

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
|--|------------|---------------|
| 3 MONTHS | 04/10/2007 | PAPER |

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/725,903

Applicant(s)

WIENEKE, BERNHARD

Examiner

Chia-Wei A. Chen

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– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 December 2003.
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-14 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☒ The drawing(s) filed on 29 April 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date See Continuation Sheet.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :12/01/2003, 12/01/2003, 11/12/2004.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 110 (a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

2. The references listed on the Information Disclosure Statement filed on 12/01/2003, 12/01/2003, and 11/12/2004, have been considered by examiner (see attached PTO/SB/08).

Drawings

3. The Figures 3 and 4 are objected to because these two figures are too dark. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application

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must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

4. Claims 12 and 13 are objected to because of the following informalities:

The limitation 'focussing' in claim 12 is misspelled.

The limitation "Scheimflug" in claim 13 is misspelled.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-6 and 9-10 are rejected under 35 U.S.C. 102(b) as being anticipated by McDowell et al. (US 5,905,568).

As to claim 1, McDowell et al. discloses a method for determining the imaging equation for self calibration (col. 7, line 47-col. 8 line 30) with regard to performing stereo-PIV

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methods on visualized flows (see col. 2, lines 42-48), said method being comprised of at least two cameras (col. 2, line 65 – col. 3, line 2) and one image sector (Fig. 1A), with the cameras viewing approximately the same area of the illuminated section but from different directions (Fig. 1A), the point correspondences between the two cameras being determined by measuring the displacement of the respective interrogation areas in the camera images using optical cross-correlation (col. 3, lines 27-39), the imaging equation being determined by means of approximation methods, using known internal and external camera parameters (col. 7, lines 49-52).

As to claim 2, McDowell et al. teaches the method according to claim 1, wherein the internal camera parameters include the focal length (col. 7, lines 18-19 and 35-36), the position of the optical axes (x_0 , y_0) (col. 6, lines 29-36) and distortion parameters of the camera optics (e.g. "camera aberrations"; see col. 4, line 2).

As to claim 3, McDowell et al. teaches the method according to claim 1, wherein the external parameters include the position and orientation of the cameras relative to each other (col. 3, lines 18-20).

As to claim 4, McDowell et al. teaches the method according to claim 1, wherein if the position of the illuminated section relative to the coordinate system of a known imaging equation is unknown, the position of the illuminated section is determined using the point correspondences (col. 3, lines 35-39).

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As to claim 5, McDowell et al. teaches the method according to claim 1, wherein if one or several internal camera parameters are known, the other internal and external camera parameters are determinable using the point correspondences in order to thus determine the imaging equation (col. 7, lines 55-65).

As to claim 6, McDowell et al. teaches the method according to claim 1, wherein two or more camera images are taken by the at least two cameras at sequential times t_0 to t_n , the two-dimensional correlation function $c_0(dx, dy)$ to $c_n(dx, dy)$ being determined by means of optical cross-correlation at each time t_0 to t_n using these images, the correlation functions c_0 to c_n being added up and the displacement dx, dy of the respective one of the interrogation areas and, as a result thereof, the point correspondences being determined after determination of the highest correlation peak (col. 12, lines 33-66).

As to claim 9, McDowell et al. teaches the method according to claim 1, wherein each camera takes in short succession two images and that additional point correspondences are determined using a cross-correlation between the images at the times t and $t+dt$ (col. 5, lines 41-54).

As to claim 10, McDowell et al. teaches the method according to claim 1, wherein the optical axes of at least two cameras are disposed coplanar to each other. (i.e., When

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the principal optical axes " Z_1 and Z_2 " of the two cameras are equal.) (See col. 6, lines 39-50.)

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over McDowell et al. (US 5,905,568) in view of Meng, Xiaoqiao and Hu, Zhanyi "A new easy camera calibration technique based on circular points."

As to claim 7, McDowell et al. teaches the method according to claim 1, but does not teach wherein the approximation method is based on the Levenberg-Marquardt algorithm.

Meng, Xiaoqiao and Hu, Zhanyi "A new easy camera calibration technique based on circular points." (Meng and Hu) teaches wherein the approximation method is based on the Levenberg-Marquardt algorithm (section 2.2 of Meng and Hu).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the Levenberg-Marquardt algorithm of Meng and Hu with the method of McDowell et al. to "optimize a cost function by solving with a standard optimization algorithm." (see section 2.2 of Meng and Hu).

As to claim 8, Elder et al. teaches wherein the RANSAC algorithm is superimposed on the Levenberg-Marquardt algorithm (section 2.3 of Meng and Hu).

9. Claims 11 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over McDowell et al. (US 5,905,568) in view of Raffel et al. (US 5,610,703).

As to claim 11, McDowell et al. teaches the method according to claim 6, but does not teach wherein the section thickness of the two illuminated sections is determined through the width of the correlation peaks and a geometrical factor and that, together with the position of the illuminated sections in the space, said thickness serves to determine the overlap between the two illuminated sections and whether they are suited for PIV measurement.

Raffel et al. teaches wherein the section thickness (e.g., light sheet thickness; col. 6, line 54) of the two illuminated sections is determined through the width of the correlation peaks and a geometrical factor and that, together with the position of the illuminated sections in the space, said thickness serves to determine the overlap between the two illuminated sections and whether they are suited for PIV measurement (see col. 6, lines 47-56).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the overlap determination of Raffel et al. with

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PIV imaging method of McDowell et al. so that "the ambiguity of the sign of the out-of-plane velocity component can be removed." (See col. 6, lines 59-61.)

As to claim 14, this claim differs from claim 11 only in that the limitation "image geometry" is recited in place of "a geometrical factor." Thus claim 14 is analyzed as previously discussed. Raffel et al. clearly teaches "image geometry" (e.g., interrogation windows; see col. 6, lines 31-40).

10. Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over McDowell et al. (US 5,905,568) in view of Walker, Stephen "Two-Axis Scheimpflug Focusing for Particle Image Velocimetry".

As to claim 13, McDowell teaches the method according to claim 5, but does not teach wherein if a Scheimpflug adapter is used and with assumption that said Scheimpflug adapter is optimally adjusted, the angle between camera chip and main axis and the position of the principal point on the camera chip are computed from the external image parameters and need no longer be fitted as a result thereof.

Walker, Stephen "Two-Axis Scheimpflug Focusing for Particle Image Velocimetry" (Walker) teaches wherein if a Scheimpflug adapter is used and with assumption that said Scheimpflug adapter is optimally adjusted, the angle between camera chip and main axis and the position of the principal point on the camera chip are

computed from the external image parameters and need no longer be fitted as a result thereof (see Section 2.1, Fig. 1a, and Fig. 1b of Walker).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the Scheimpflug adapter of Walker with the method of McDowell et al. to "permit focusing on a plane from a non-orthogonal position relative to the plane of measurement." (See Section 1 of Walker.)

As to claim 12, Walker teaches wherein with assumption of focusing on the particles in the illuminated section during the approximation method, the image width is calculated as a function of the focal length of the objective and of the spacing between the illuminated section and the camera and needs no longer be fitted as a result thereof (see equation (1) of Walker).

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Palm (US 5,699,444) discloses methods and apparatus for using image data to determine camera location and orientation.

Krumm (US 6,789,039 B1) discloses a relative range camera calibration.

Elder et al. (7,130,490 B2) discloses an attentive panoramic visual sensor.


Inquiries

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chia-Wei A. Chen whose telephone number is 571-270-1707. The examiner can normally be reached on Monday - Friday, 7:30 - 17:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chanh Nguyen can be reached on 571-272-7772. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

CC
3/27/07


CHANH D. NGUYEN
SUPERVISORY PATENT EXAMINER